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Trends, Influential Authors and Emerging Themes in Intelligent Personal Assistants: A Bibliometric Analysis

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Abstract
Purpose- This study aims to analyse the existing work done in the area of intelligent personal assistants using comprehensive bibliometric analysis and suggest directions for future research in this domain.
Design/approach/methodology- A systematic procedure, step by step was carried out for this analysis. After using a predefined search string, we were left with 317 articles published in reputed journals in the database of Scopus. To understand this domain's current state, execution of bibliographic coupling and keyword analysis was done and future directions were suggested.
Findings- We used the VOSviewer for analysing and visualising data. The results of this study show the trends of publication in the field of Intelligent Personal Assistants along with the most contributing countries, authors, and journals. The authors of the United States and the United Kingdom were observed to have the highest number of collaborations. Seven clusters were identified after using bibliographic analysis. At last, this study suggested a future road map by keyword analysis in the field of Intelligent Personal Assistants.
Originality/value- The interest of researchers has increased in the field of Intelligent personal assistants over the past decades. There is a large volume of existing research in this field, still this literature is insufficient for providing complete knowledge of Intelligent Personal Assistants.

Keywords- Voice assistants, Intelligent personal assistants, Literature review, Bibliometric analysis
Paper type- Literature review

1. Introduction

The usage of artificial intelligence-enabled personal assistants is growing at a fast rate and is facilitated due to their integration in different digitally operated devices (e.g., Apple Home Pod, Amazon Echo etc.) (Guha et al., 2022; Choi & Drumwright, 2022). Intelligent personal assistant is among the types of technology-integrated devices with artificial intelligence that respond to voice commands or questions from users and provide them with information, perform tasks, or control other devices (Saad et al., 2016). The technology behind these intelligent personal assistants is based on natural language processing which allows them to understand spoken language and respond in a way that sounds natural and human-like. They use machine learning algorithms to improve their responses over time based on feedback from users and new data (Hoy, 2018). Nowadays, various domains like homes, cars, phones etc. are using the Intelligent Personal Assistants in the entire world. Apple's Siri, Google Assistant, Amazon's Alexa, and Microsoft's Cortana are among some world-famous voice assistants. Various tasks of daily life like playing music, making phone calls, setting reminders, controlling smart home devices and asking questions of general knowledge can be performed by these assistants (Han & Yang, 2018). These Intelligent Personal Assistants are able to communicate with humans in the same manner as humans communicate with each other and to make jokes or play with them. This creates an emotional as well as social closeness with these assistants. Human-computer interactions in the forms of software or avatars lead to the development of relationships (Schroeder, 2002: Liu et al., 2011).

A comprehensive overview is the primary contribution of this study and located the recent domain through

the bibliometric analysis technique. Researchers will be assisted by the findings of the publication pattern of this study. This is the first study, in the knowledge of the authors, that uses the Scopus database for the conduction of systematic bibliometric analysis in the field of Intelligent Personal Assistants.

The Rationale of the Study

Researchers have worked for nearly 3 decades in the field of Intelligent Personal Assistants with different theoretical perspectives.

There is a lack of bibliometric analysis in the field of Intelligent Personal Assistants. The technique of bibliometric analysis is necessary for knowing the orientation and intensity of research lines (Liu & Avello, 2020). It shows the linkage between existing literature, analysis of citation, and level of co-citation using bibliographic data (Zainuldin and Lui, 2022), quantitatively as well as qualitatively (Hew, 2016). To develop a better understanding of existing research literature in this field, our study carried out this analysis.

The research objectives (ROs) of this study are as follows:

RO1. To find the annual publication trend in the field of Intelligent Personal Assistants.

RO2. To find the most contributing authors, journals, institutions and countries in the field of Intelligent Personal Assistants.

RO3. To find the most influential research articles in this domain.

RO4. To find the most prevalent themes in the field of Intelligent Personal Assistants.

2. Methodology

For analysing the ideas of previous work and translating them into systematic order to specify, define, map and evaluate the content, the technique of reviewing existing literature is used. Traditional techniques of reviewing are not very effective in finding the intellectual structure of this field (Zainuldin and Lui, 2022; Batra et al., 2022). The systematic literature review, a type of conventional method, is able to overcome this issue. It helped in obtaining a broad overview of existing studies on a topic by initial examination in a complete, formal, impartial and meticulous manner (Victorelli et al., 2019). Bibliometric analysis gained popularity because of analysing the output scientifically (Donthu et al., 2021). The Scopus database is analysed quantitatively for bibliometric analysis as the Scopus database has more coverage in terms of citations (Sood et al., 2022). We have adopted VOSviewer which uses association strength similarity measure (Ante, 2020), among the various available software for bibliometric analysis and explained the existing published research work in the form of leading authors, countries or journals in this specific field and a holistic approach is used for evaluation (Khatib et al., 2021; Batra et al., 2022).

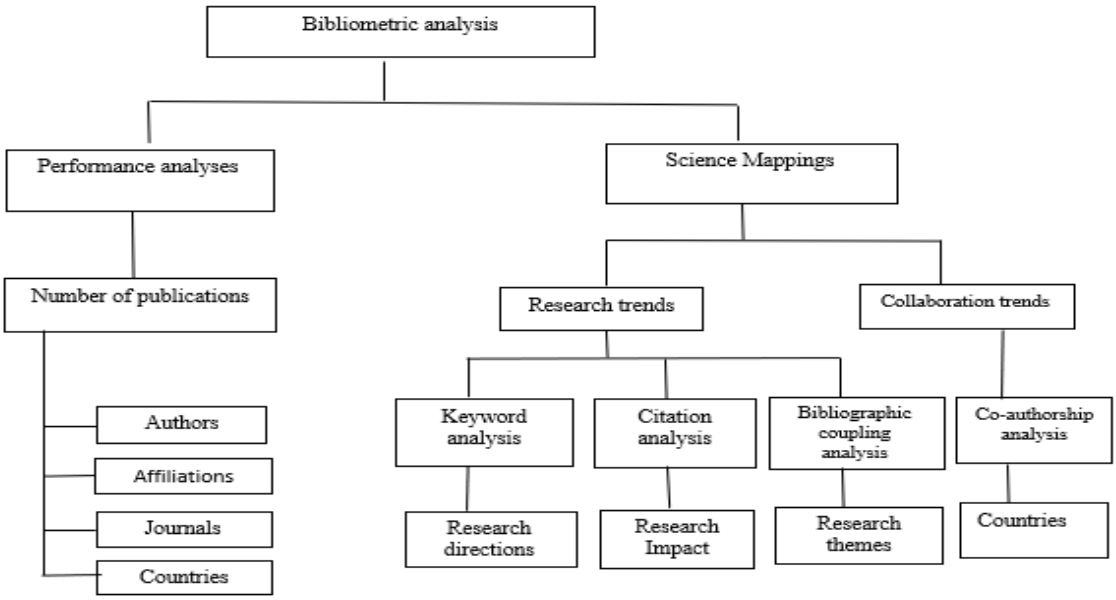

Fig 1: Bibliometrics' Topology (Batra et al., 2022)

2.1 Defining search terms

The strategy is clear, transparent and reproductive in nature used for bibliometric analysis (Khatib et al., 2021; Batra et al., 2022). The initial search for our study was performed on May 10, 2023, for extracting our documents. The most important part of extracting databases in the bibliometric analysis is selecting the right keywords (Jain et al., 2021). This study has analysed previous literature in this domain to determine the appropriate search terms. The research string developed for this study was ((“Siri” OR “Alexa” OR “Google assistant” OR “Voice assistant*” OR “Intelligent personal assistant*” OR “Artificial voice assistant*” OR “Digital Assistant*”)). The limit was applied to the article title as it decreases the probability of exclusion of any relevant article.

2.2 The Screening and Selection Procedure

Scopus is one of the known databases as it is more exhaustive in nature having citations largest data of abstracts as well as citations than other databases (Chalissery et al., 2022; Farroq, 2022; Batra et al., 2022; Zainuldin and Lui, 2022). The initial search left us with 2020 articles in the Scopus database. For getting more clear data, we used a filtration process for narrowing down the database. That’s why firstly, the limit was applied on subjects and we chose research work in the discipline of Social Science and Business Management & Accounting and excluded 1568 articles. Then we removed 116 articles of book chapters and conference papers by using the limit of ‘only articles and review articles’ and we were left with 336 documents. Lastly, we selected articles in the English language along with the “Journal” source type and we were left with 317 articles. Thus, we got our final database of 317 articles for our study. (Figure 2 shows the process of filtration).

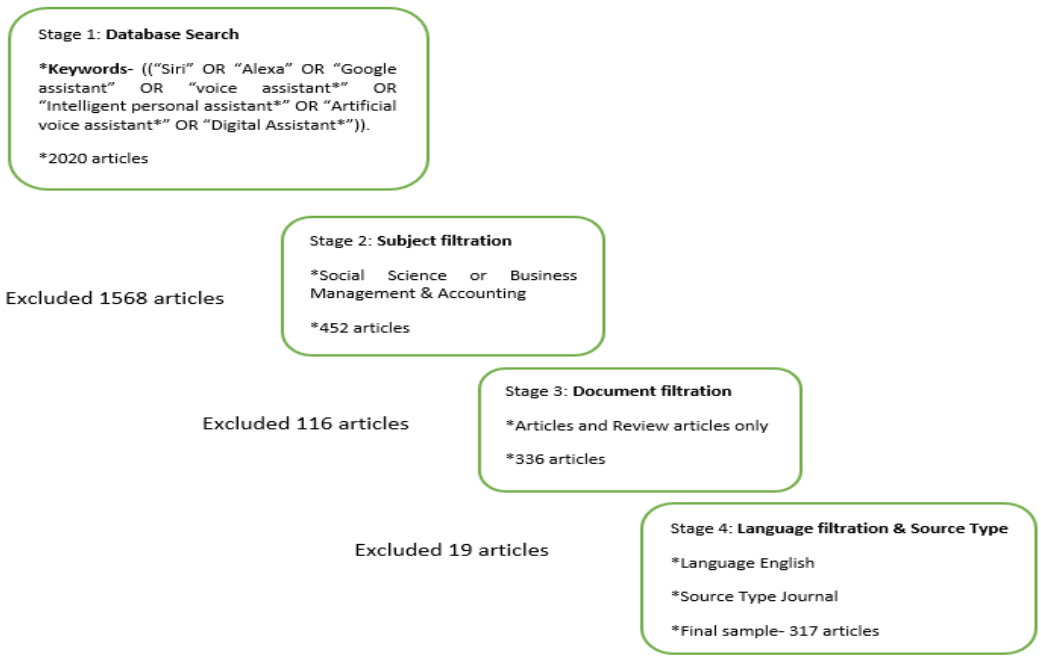

Fig 2: Process of Articles Search and Filtration

3. Results and Discussion

3.1 The Performance Analyses

3.1.1 Publication trend in chronological order- Figure 3 explains the RO1 and shows the publications in the field of Intelligent Personal Assistants starting from 1995 to May 10, 2023. The annual growth of publication of articles is shown i.e., from 1 in 1995 to 66 in 2022. For better analysis and understanding, it can be divided into different time periods. At first glance, it was very low in the initial years from 1995 to 2001. While in the second period of 2002 to 2015, it is showing slight growth in publications still having only around 23% of the total publications. In recent years, the graph has shown rapid growth in the number of publications and is around 74% of the total publications. Over the years, the graph shows an upward hike in the trend of the number of publications in the domain of Intelligent Personal Assistants.

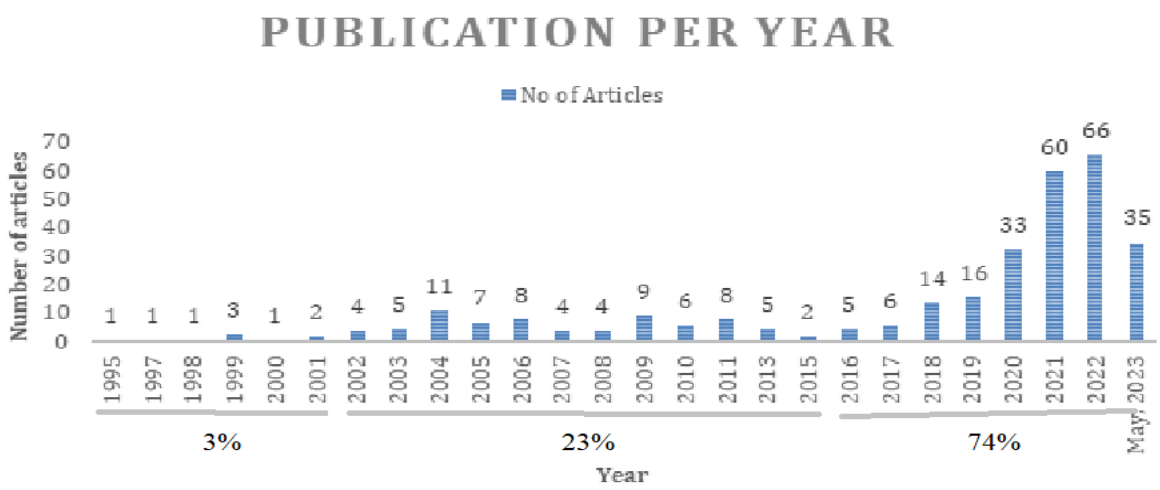

Fig 3: Publication trend of articles per year (till 10th May, 2023)

3.1.2. Leading Journals- A total of 317 research articles based on the theme of Intelligent Personal Assistants have been published in a total of 199 journals. The table shows the most contributory journals in this field. "Proceedings of the ACM on Human-Computer Interaction" is the top contributing journal with 10 number of articles and is followed by the journal Psychology and Marketing with 8 number of published articles. The top contributing 14 journals are the most active ones having 81 numbers of published articles and a share of around 25% of the total publications. Most of the journals in this list are ranked with "A" or "B" by "Australian Business Deans Council".

Table 1: The Top Contributing Journals in the field of Intelligent Personal Assistants

Source	Publisher	Documents	Citations	Ranking
Proceedings of the ACM on Human-Computer Interaction	Association for Computing Machinery	10	420	
Psychology and Marketing	John Wiley and Sons Inc	8	283	A
Journal of Business Research	Elsevier	8	298	A
International Journal of Human-Computer Interaction	Tayler and Francis online	7	17	B
Interactive Learning Environments	Routledge	7	69	
Technological Forecasting and Social Change	Elsevier	6	40	A
Proceedings of the Association for Information Science and Technology	John Wiley & Sons Inc.	5	22	
Journal of the Medical Library Association	Medical Library Association	5	171	
Journal of Retailing and Consumer Services	Elsevier	5	82	A
Medical Teacher	Taylor & Francis	4	63	
Library Philosophy and Practice	University of Idaho Library	4	11	
International Journal of Human-Computer Studies	Elsevier	4	20	B
Convergence	SAGE Publications Ltd	4	28	

Computer Assisted Language Learning	Taylor and Francis Ltd.	4	54	

3.1.3 Leading authors- The list of top contributing authors in the field of Intelligent Personal Assistants is shown in Table 2. It shows that among 810 authors, Irene Lopatovska along with Howard Hao-Jan Chen are the leading authors with 6 articles. The most influential author is Irene Lopatovska with 157 followed by Howard Hao-Jan Chen with 53 number of citations.

Table 2: The Top Contributing Authors in the Field of Intelligent Personal Assistants

Author	Documents	Citations	Total link strength	Citation per article
Irene Lopatovska	6	157	4	26.167
Howard Hao-Jan Chen	6	53	39	8.833
Gilbert Dizon	5	98	38	19.6
Michelle Cohn	4	15	0	3.75
Tzu-Yu Tai	4	31	20	7.75
Georgia Zellou	4	15	0	3.75
Gary Burnett	3	62	4	20.67
Amandeep Dhir	3	14	6	4.67
David R. Large	3	62	4	20.67
Suresh Malodia	3	14	6	4.67
Anouk Mols	3	29	5	9.67
Jason Pridmore	3	29	5	9.67

3.1.4 Leading institutions and countries- The list of institutions having topmost contributions in the field of Intelligent Personal Assistants are shown in Table 4, National Taiwan Normal University, Taiwan and Himeji Dokkyo University, Japan are at the top with 5 articles each and are followed by National Tsing Hua University, Taiwan and Pratt Instituteny, United States with 3 articles. In the list of top 10 prominent institutions, three are from the United States followed by Taiwan and Japan having 2 institutions.

Overall, 61 countries have contributed to the field of Intelligent Personal Assistants in this entire set of documents. Table 3 shows that the United States is at the top with 126 articles, followed by the United Kingdom with 31 articles and India with 22 articles. The United States alone is contributing around 40% of articles in this field.

Table 3: The Leading Countries in Terms of Contribution in the field of Intelligent Personal Assistants

Country	Documents	Citations	Total link strength	Total link
United States	126	2811	4224	12
United Kingdom	31	465	4776	15
India	22	162	3359	12
Canada	15	460	884	6
Italy	13	71	1596	8
Germany	13	336	670	4
Spain	13	89	1833	7
Taiwan	13	169	969	4
Australia	12	121	1168	8
China	12	170	2759	10

For advancing scientific research, cross-country collaboration is a must (Khatib et al., 2021). That's why the co-authorship network has been analysed for 61 countries with 810 authors. Figure 4 shows the collaboration of countries by using bibliometric analysis techniques and resulted in 5 clusters having 19 countries after applying the threshold limit to 5, showing the United Kingdom along with the United States having more linkage strength compared to others. It shows a better relationship between the two countries (Khatib et al., 2021; Batra et al., 2022) and provides a deeper understanding of the study (Donthu et al., 2021). The United Kingdom is linked to 15 nations with a total link of 4776, followed by the United States as the most productive nation, having linkage with 12 nations with a total link strength of 4224, followed by India linkage with 12 nations and a total link strength of 3359, showing the association between these nations on the theme of Intelligent Personal Assistants.

Table 4: The List of Leading Institutions in field of Intelligent Personal Assistants

Organization	documents	citations	Country
Himeji Dokkyo University	5	110	Japan
National Taiwan Normal University	5	72	Taiwan
National Tsing Hua University	3	11	Taiwan
Pratt Instituteny	3	143	United States
University of Nottingham	2	21	United States
King's College London	2	11	United Kingdom
University of Stavanger	2	9	Norway
Otemae University	2	14	Japan
University of California	2	13	United States
Sapienza university of Rome	2	5	Italy
Indian Institute of Technology, Bombay, Mumbai	2	21	India
University of Colorado School of Law	2	35	United States
University of Washington	2	93	United States

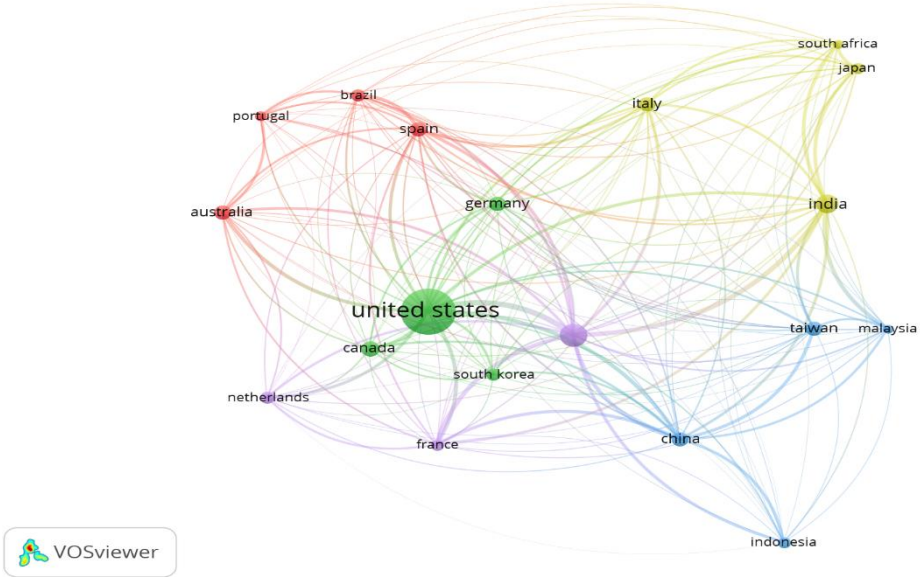

Fig 4: *The Co-authorship between Countries*

4. Science Mapping

4.1. Citation analysis-

For accomplishing RO3, we used citation analysis to get to know about the most influential research articles. Table 5 shows the leading influential articles in the field of Intelligent Personal Assistants.

Table 5: The Top Influencing Articles in the field of Intelligent Personal Assistants

Document	Title	**Journal name**	**Citation**	**Link**	**Citation per year**
Hoy (2018)	Alexa, Siri, Cortana, and More: An Introduction to Voice Assistants	Medical Reference Services Quarterly	417	0	83.4
Golden and Geisler (2007)	Work–life boundary management and the personal digital assistant	Human Relations	152	0	9.5
Han and Yang (2018)	Understanding adoption of intelligent personal assistants: A parasocial relationship perspective	Industrial Management and Data Systems	133	27	26.6
Fernandes and Oliveira (2021)	Understanding consumers' acceptance of automated technologies in service encounters: Drivers of digital voice assistants adoption	Journal of Business Research	130	18	65
Bayus et al. (1997)	Too Little, Too Early: Introduction Timing and New Product Performance in the Personal Digital Assistant Industry	Journal of Marketing Research	127	0	4.89
Lopatovska et al. (2019)	Talk to me: Exploring user interactions with the Amazon Alexa	Journal of Librarianship and Information Science	122	9	30.5
Moriuchi (2019)	Okay, Google!: An empirical study on voice assistants on consumer engagement and loyalty	Psychology and Marketing	110	39	27.5
Chung et al. (2017)	Digital forensic approaches for Amazon Alexa ecosystem	Digital Investigation	106	0	17.67
Pradhan et al. (2019)	"Phantom Friend" or "Just a Box with Information": Personification and Ontological Categorization of Smart Speaker-based Voice Assistants by Older Adults	Proceedings of the ACM on Human-Computer Interaction	90	29	22.5
Garrett and Jackson (2006)	**A mobile clinical e-portfolio for nursing and medical students, using wireless personal digital assistants (PDAs)**	Nurse Education Today	89	0	5.23

Brill et al. (2019)	Siri, Alexa, and other digital assistants: a study of customer satisfaction with artificial intelligence applications	Journal of Marketing Management	89	45	22.25
Pinkwart et al. (2003)	Educational scenarios for cooperative use of Personal Digital Assistants	Journal of Computer Assisted Learning	85	0	4.25
Pitardi and Marriott (2021)	Alexa, *she's* not human but… Unveiling the drivers of consumers' trust in voice-based artificial intelligence	Psychology and Marketing	85	74	42.5
Mechling et al. (2010)	Evaluation of a personal digital assistant as a self-prompting device for increasing multi-step task completion by students with moderate intellectual disabilities	Education and Training in Autism and Developmental Disabilities	76	1	5.84

The article "Alexa, Siri, Cortana, and More: An Introduction to Voice Assistants" by Hoy (2018) has the maximum number of citations in this domain in "The journal "Proceedings of the ACM on human-computer interaction" with citation 417 leading in this domain. The article "Alexa, Are You Listening?: Privacy Perceptions, Concerns and Privacy-seeking Behaviors with Smart Speakers" by Lau et al. (2018) in the journal "Proceedings of the ACM on Human-Computer Interaction" has 291 citations and is followed by "Work-life boundary management and the personal digital assistant" having authors Golden & Geisler (2007) in journal "Human Relations" having 152 number of citations are the leading influential articles of this domain.

4.2 Bibliographic coupling analysis

Bibliographic analysis shows many disciplines related to a specific topic (Nilashi et al., 2022). When a large number of citations are in common between two articles, it indicates the high strength of coupling (Jain et al., 2021; Donthu et al., 2021). Bibliographic coupling shows that there are high chances of similar content in articles (Batra, 2022). For examining the intellectual structure with a dynamic approach, the bibliographic coupling is used in specific subject fields (Koseoglu, 2016; Zainuldin and Lui, 2022; Batra, 2022). That's why we applied bibliographic coupling to get to know about the clusters in the field of Intelligent Personal Assistants. As we have a total of 317 articles left with us after filtration and there is presence of a large number of articles that have been cited together, we applied a limit of a minimum of 10 times the threshold level in this study for the creation of clusters. Finally, we got 7 clusters with 113 articles (see Figure 5). In Figure 5, the dots represent publications and the lines represent the connection between publications. Higher-density dots show higher weightage while low-density dots exhibit low weightage. The same color of cluster indicates the connection in themes of articles, which is generated by using the clustering technique (Korte et al., 2021).

Cluster 1: Intelligent Personal Assistants and Conversational Agents. The cluster in red is the largest network cluster as shown in figure 5. The articles of this cluster are concerned with the role of intelligent personal assistants as conversational agents and how people of different ages are accepting these assistants in their lives. Different age group reacts differently towards the voice assistants. Such as children usually prefer personified interfaces but younger children like naming personification (Yaun et al., 2019). Older adults enjoy companionship with voice assistants when these assistants have characteristics of anthropomorphism (Pradhan et al., 2019). While people above the age of 55 are using voice assistants as a tool for doing daily tasks like playing music, calling, or commanding smart home appliances. This demographic group is the most satisfied group with voice assistants

(Koon et al., 2019). The feminine characteristics of voice assistants' persona encourage the users to share their intimate data with them which in turn contributes to surveillance capitalism (Woods, 2018). Sometimes, when the information provided by Alexa is not sufficient, users feel satisfied because they enjoy the interaction process more than the output (Lopatovska & Oropeza, 2018). Overall, People are accepting of the nature of Voice-based home appliances (Pridmore & Mols, 2020).

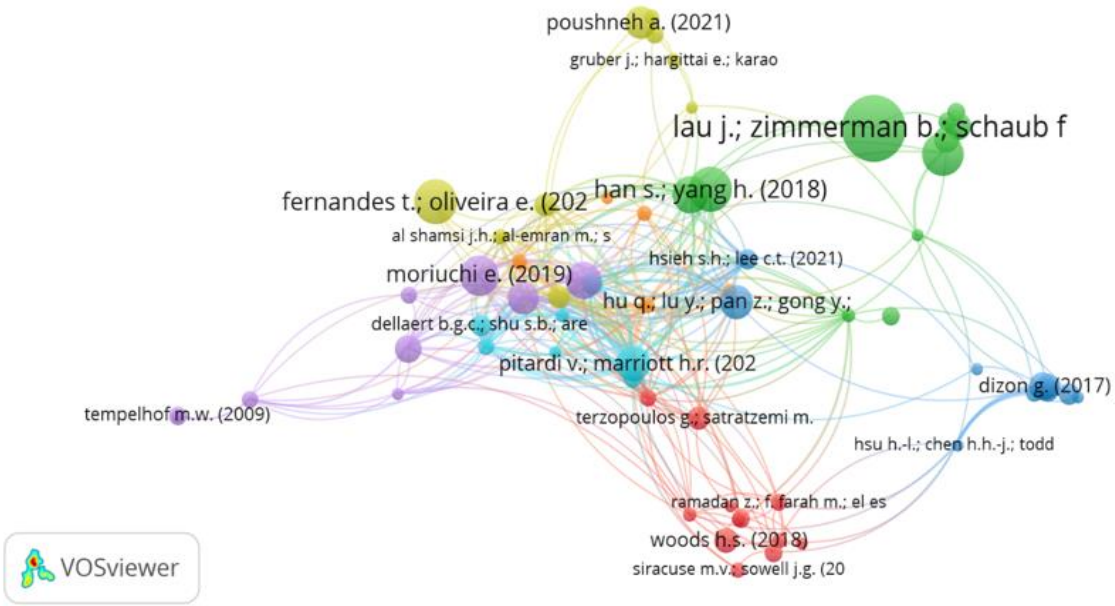

Figure 5. *The Network Mapping of Bibliographic Coupling Analysis in the field of Intelligent Personal Assistants*

Cluster 2: Intelligent Personal Assistants and drivers for their adoption. The 2nd cluster in green color is the second largest as shown in Figure 5 and it suggests the key factors that encourage users towards Intelligent Personal Assistants. Factors like trust, privacy concerns, enjoyment, ease of usefulness and security impact the users' perception towards these voice assistants positively impact the attitude of users (Shamsi et al., 2022; Acikgoz & Vega, 2021; Fernandes & Oliveira, 2021; Lau et al., 2018; Kim et al., 2021). But the privacy concerns negatively affect their perception. When people have positive thinking about privacy it increases their trust in these assistants and a positive attitude is created (Acikgoz & Vega, 2021; Fernandes & Oliveira, 2021). Other factors such as warmth and emotional support shown by voice assistants and the interaction experience of people, increase the satisfaction level of the customers and induce favourable customer outcomes (Brill et al., 2019; Gelbrich et al., 2021). The social abilities of conversational agents are inspired by human behavior and the expectations of human towards these agents affect the intimacy as well as adoption level of the agents (Potdevin et al., 2020) and further, consumer intimacy and commitment towards voice assistants leads to customer loyalty (Hernandez-Ortega & Ferreira, 2021).

Cluster 3: Intelligent Personal Assistants and Learning Language. The cluster in blue color is related to the role of intelligent personal assistants in learning something new. Voice assistants are useful in learning, speaking and listening skills (Chen et al., 2020; Xu, 2020; Dizon, 2017). The ability of voice assistants to understand the pronunciation of users, answering their queries and compatibility with users enhance their experience (Moussalli & Cardoso, 2019). The higher-level learner was more comfortable as compared to the low-level learner due to their mispronunciation (Chen et al., 2020; Dizon, 2017). Voice assistants give learners a less threatening environment, confidence, motivation and a higher level of engagement in learning a new language (Tai & Chen, 2020). Users who were using voice assistants to learn a second language were enjoying this process (Chen et al., 2020; Dizon, 2017) but still sometimes when students are facing issues in communication, it leads some students to leave to give up on voice assistants (Dizon & Tang, 2020).

Cluster 4: Intelligent Personal Assistants and Consumer Behavior. The yellow cluster depicts the consumer

behavior towards Intelligent Personal Assistants. Factors like functional, social and relational factors affect consumer behavior towards IPAs (Fernandes & Oliveira, 2021). Attributes of IPAs like human-like attributes, contextual attributes, and contextual factors work as the antecedents for their continuance use (Aw et al.,2022; Poushneh, 2021). These psychological factors help the IPAs in giving recommendations to consumers that directly affect the satisfaction level of consumers (Mishra et al., 2022). Privacy concerns of consumers can affect the decisions of consumers in their acceptance level (Ebbers et al., 2021).

Cluster 5: Intelligent Personal Assistants and Brand Engagement. The violet cluster shows the role of Intelligent Personal Assistants in brand engagement. The adoption and brand loyalty of consumers towards IPAs are affected by their primary features like novelty, anthropomorphism, security, perceived usefulness, trust, perceived risk etc (Hasan et al., 2021; McLean et al., 2021; Lopatovska & Oropeza, 2018; Moriuchi, 2019). The interaction of consumers with IPAs also affects the satisfaction level of consumers (Brill et al., 2019) as the process of interaction is more important than the output (Lopatovska & Oropeza, 2018). Brand involvement and consumer innovativeness are impacted by the use of IPAs and can be used by brands for their brand building (Brill et al., 2019).

Cluster 6: Intelligent Personal Assistants and Work Productivity. The orange color shows the 5th cluster that reveals the role of the presence of intelligent personal assistants in the workplace. IPAs are shifting from home technology to the workplace through various paths like as integration with devices used in accounting and management (Burns & Igou, 2019; Marikyan et al., 2022). Intelligent Personal Assistants help in keeping records, clinical calculators and medical reference (Jotkowitz et al., 2006). The implementation of voice assistant in clinical practice promotes reflective learning during practice, helps the students in the translation of knowledge and improves productivity at the workplace as well as prevents the feeling of isolation (Garrett & Jackson, 2006). Nursing students were satisfied with the use of voice assistants in their medical practice due to their innovative nature and helping them to increase their productivity (Cibulka & Crane-Wider, 2011; Johannson et al., 2013; Miller et al., 2005).

Cluster 7: Intelligent Personal Assistants and Web interface. The final cluster is of sky-blue color that explains the use of Intelligent Personal Assistant in the web interface. IPAs can also work as web interfaces and affect access to the web for information, understanding, production, purchasing and consumption (Natale & Cooke, 2021; Liew & Tan, 2017). Consumers are satisfied with the interaction with IPAs but still, there is a need to improve them for a better experience while using them for retrieving information as a traditional system, a causal leisure system or just using them as an interface of a toy or in integration with smart home (Lopatovska et al., 2019). Any technology has more impact in its use when it has feminine qualities in its interface like voice pitch, looks, body appearance etc. (Bergen, 2016).

4.(c). The Network Mapping of Keyword Co-occurrence Analysis

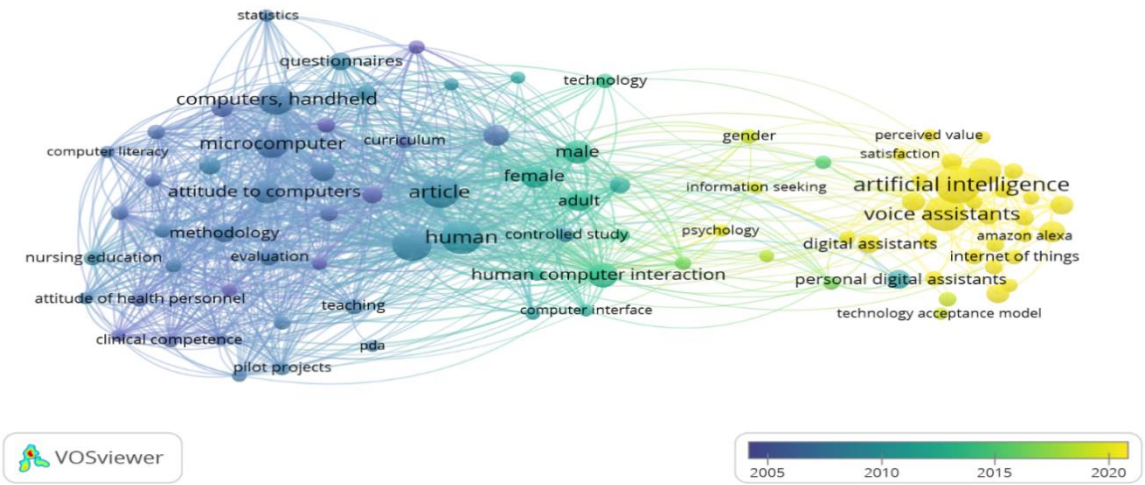

Fig 6: The Network Mapping of Keyword co-occurrence Analysis in the field of Intelligent Personal Assistants

The analysis of keyword occurrence is based on the density and shows the times a keyword has been used, clusters are created using a set of keywords, a cluster shows the similarity in the keywords and it indicates the similarity in the themes of that cluster. It helps provide directions to new researchers in the specific field in a simple way (Rejeb et al., 2022) by detecting high-frequency keywords after evaluating the literature (Saheb & Izadi, 2019). The keyword co-occurrence helps in getting the trending keywords according to year (Goksu, 2020). We created the network mapping of keywords after applying the limit of minimum occurrence of keywords to 5 which is shown in Figure 6. The larger size of the nodes shows the larger number of times a keyword has been used and if a keyword is used for a smaller number of times, it is represented by a small node. The change of colour of clusters shows the change of theme over a period of time. This analysis shows three major clusters for this study. In the entire mapping, 'human-computer interaction' is the largest node that shows the centrality which means the influence and importance of a particular node in a specific network (Sarsenbayeva et al., 2023). The first cluster in violet color shows that at an initial stage, the cluster is showing the keywords, i.e. microcomputer, computers handheld, computer program etc. that were used, then the trend changes to the cluster in green color, having keywords human-computer interactions, technology, education etc. Then this trend was followed by keywords like a human experiment, digital devices etc. and a lot of literature is presently related to these keywords. In the current scenario, the cluster in yellow color shows artificial intelligence, Voice assistants, intelligent personal assistants, satisfaction, consumption behavior, internet of things, perceived value etc. as the most emerging keywords and their small nodes show that these are the least explored areas. The cluster in yellow color shows the recent trends of keywords and are the least explored areas. Satisfaction, perceived value and consumption behaviour are the recent topics in this domain. That's why, a lot of research and contribution can be done in this specific domain.

5. Future Research Directions

The role of Intelligent Personal Assistants in the daily lives of humans has been increasing day by day for the last few years. Based on this analysis we can conclude that research in the field of IPAs is growing but still there are some domains that need to be explored and these domains are suggested as follows-

5.1 Psychological Aspect Towards IPAs

Studies by Lee et al. (2021) and Moore & Urakami (2022) show that the trust, privacy, security, perceived usefulness, satisfaction, memory, and process inhibition of IPAs affects the adoption behavior of consumers in any product by consumers while safety, ease-in, personalization, perception & sensations towards the IPA integrated devices has been discussed by Mueller et al. (2021). Berrett et al. (2022) stated the benefits of augmented technology, smart mirror and digital projectors while the protective behavior towards privacy has been observed by Williams et al. (2019). But some questions like among each age group, what are the most influencing factors for consumers need to be answered. Can these psychological factors be influenced by marketers?

5.2 Perceived value and consumption behavior towards IPAs

Studies have been done on the consumers' perceived value towards the suggestions given by IPAs such as Poushneh (2021) suggested that factors like sincerity, creativity, and intelligence of IPAs lead to customer satisfaction & and intention to use them on a continuance basis. The recommendations given by IPAs affect the perception, convenience, credibility, task functions & and usefulness in consumers' minds (Flavian et al., 2022; Malodia et al., 2021). Consumers are becoming habitual of the IPAs for their daily life necessities. However, the perceived value of IPAs in their lives is still not fully explored. How can this value be created by marketers? How the perceived value of IPA affects the experience or satisfaction of consumers should be studied. The factors affecting the perceived value of IPAs should be explored and how marketers can use this for favourable outcomes. In which category of devices, are consumers comfortable with IPAs or further in which product category do consumers want integration of IPAs? What are the factors that favour the adoption of IPAs in new categories?

5.3 Intelligent Personal Assistants and Education

The role of IPAs in learning new languages is growing along with the impact of IPAs in the domain of clinical student learning. IPAs show a positive relation in learning any new language and help the learners by practising with them (Chen et al., 2020; Dizon, 2017). Consumer satisfaction while learning a variety of musical

activities using IPAs has been studied by Turchet et al. (2023). Interactive Virtual Training positively affects the teachers on learning ability, effectiveness and efficiency (Delamarre et al., 2021). However, the role of IPAs in learning any skill or any professional education in comparison with traditional methods is scarcely explored. Questions like Can IPAs can replace a teacher? Can IPAs help the students in getting Practical knowledge? Does IPAs have the ability to affect the learning ability of students?

5.4 IPAs as a marketing tool

Factors like justice, explicability, autonomy, privacy, intimacy, and feedback affect the acceptability level toward artificial social agents (Richards et al., 2023; Etzrodt, 2022). The applications of voice technology in wearable items like watches positively influence the consumers (Wilmott et al., 2017) but there is a dearth of studies that can explain the factors that actually have an impact on marketing and can influence the consumers. What strategies should be adopted for promoting the IPA-integrated devices? How can IPAs contribute to decreasing the cost of marketing? How can IPAs be used to build brand and brand loyalty?

6. Conclusion

This study investigated the work done in the field of Intelligent Personal Assistants by analysing the publications indexed in the database of Scopus. It identified the trends of publications per year, the leading influential authors, the top contributing journals, articles that have contributed in this domain and at last the most emerging keywords are identified by using bibliographic coupling of keywords.

This domain of Intelligent Personal Assistants has been in existence since the last few decades but it gained momentum from the year 2017 onwards. Our study shows that "Proceedings of the ACM on human-computer interaction" is the top contributing journal with 10 articles and 420 citations followed by "Psychology and Marketing" with 8 articles and 283 citations. Irene Lopatovska is the most contributing and influencing author with 6 articles and 157 citations along with Howard Hao-Jan Chen and Gilbert Dizon with 6 & 5 articles and 53 & 98 citations respectively. The leading countries in this domain are the United States with 126, the United Kingdom and India with 31 and 22 articles respectively.

We used bibliographic coupling analysis for documents and revealed seven themes related to the domain "Intelligent Personal Assistants" and these are first one is Intelligent Personal Assistants and Conversational agents, second, Intelligent Personal Assistants and Drivers for their adoption, third, Intelligent Personal Assistants and Learning language, fourth, Intelligent Personal Assistants and Consumer Behavior, fifth, Intelligent Personal Assistants and Brand Engagement, sixth, Intelligent Personal Assistants and Work productivity and lastly, Intelligent Personal Assistants and Web interface. Finally, keyword analysis shows the future direction for researchers.

The researchers can explore the factors affecting the perceived value, consumption behavior, and adoption towards IPA integrated products. The role of IPAs in learning new skills and experience during practical knowledge should be examined along with their role as a marketing tool in building a brand name as well as brand loyalty in further research.

This study contributes to analysing the existing literature in the field of Intelligent Personal Assistants but with some drawbacks e.g., we have used only the Scopus database for our study but other databases such as web of science, PubMed or Dimensions etc. can also be used in future researches.

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